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ABSTRACT

Presented is an overview and model of the proposed curriculum development process in environmental education in Connecticut. Concepts and competencies are identified at each grade level and are designed to facilitate the infusion of environmental education activities within the existing curricula using existing learning resources such as Earthwatch, Project Learning Tree, and Outdoor Biological Instructional Strategies (OBIS). Concepts are classified into six categories: ecosystems, population, ethics, resources-energy, economics-technology, and environmental quality. Concepts are further classified as those central to environmental education and those assumed to be in the existing curricula. (BT)

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A PROPOSAL

for

a K-12 sequence of

Environmental Education Competencies



by

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INTRODUCTION TO ENVIRONMENTAL EDUCATION COMPETENCIES

I. The Context: The concepts and objectives as presented in this project, can better be viewed as a useful tool with a clear understanding of the broader curriculum development efforts made by the Environmental Education Center. To review the concepts and objectives as a product in themselves is to ignore the holistic approach adopted by the Environmental Education center to the development of Environmental Education. The purpose of this introduction is to give the reader an overview of the curriculum development process as perceived by the EEC staff.

II. Infusion: The Central Thrust of the EEC Curriculum Development Effort:

Most educators agree that environmental education should be dedicated to producing environmentally literate citizens. Such a process should produce citizens equipped with factual and unbiased information concerning the basic ecological systems, skilled in problem-solving and decision-making and motivated to take an active role in working toward the maintenance of an ecologically-sound environment.

The ultimate objective of involvement in an environmental learning program is to enable people to think reasonably and thoughtfully about their environment. This will come about through specific and continued experiences with their environment. Any single experience is not enough. In time, experiences will accumulate to the extent that students can visualize patterns and causes and effects which make sense to them and which relate to other aspects of life. In order to teach this goal, it is important that students have environmental learning experiences on a continuing basis throughout their lives. There are basically two approaches to implementing environmental education to reach this goal.

1. Environmental education uses the skills and information of various disciplines.
2. Each discipline can use environmental activities to teach the knowledge and skills of that discipline.

The problem of the first approach is that if we continue to "take time out" from the everyday instructional program to deal with environmental problems, they will remain adjunct concerns. In addition, there is always the problem of one more unit in an already crowded program. On the other hand, if we prepare a program of instruction which is customized with or has environmental objectives built in, our attention to such concerns will be as regular and automatic as the social occurrence of the problems themselves. It is this second alternative that has been developed in this project which has resulted in an EE Infusion Activity notebook.

Infusion is not a new concept. It is in fact an integral part of the entire education process. Every teacher strives to integrate and piece together for their students the many topics, subjects and categories that divide the school day. Writing skills are not isolated exercises to be performed during an English lesson but are important tools of communication in science, social studies and the language arts.

The ACES Environmental Education Infusion Project is a two-fold response to this aspect of the teaching process. In response to the crowded curriculum, the infusion approach frees a teacher to environmentalize their classroom to any extent. By selecting one or more EE infusion activities, a teacher can highlight the environment in key spots throughout the school year.

And perhaps more importantly, by integrating environmental education into a multitude of disciplines and topic areas, the students' thinking comes to reflect an environmental ethic which spans the individual curriculum topics. Rather than viewing environmental education as a day to collect litter or as a bulletin board of pollution posters, students begin to apply their environmental awareness and knowledge in all their classroom activities and investigations.

III. Existing Curricula in Each District Becomes the Vehicle for Realizing the Goals of EE.

Adoption of the infusion approach to EE may be viewed as a constraint or as an opportunity. It is a restraint in that all efforts in EE must be congruent with existing curricula. It is an opportunity in that the barriers to curricula change are minimized and the potentials for implementation maximized. The EEC staff have assumed the opportunistic view. In assuming this view, traditional curriculum development strategies became inappropriate. To illustrate, below are outlined both the curriculum development approach used by the EEC staff and a more traditional approach to EE curriculum development. The purpose of this comparison is not to establish EEC strategies as absolute or ideal but rather to share with the reader the context in which the competencies were developed.

Traditional Curriculum Development

1. Development of a Learning Model:

This step would include research into existing EE learning models and would culminate in the adoption or modification of an existing model.

Advantages: A clear focus for all future effort is established. Curriculum writers establish benchmarks for future development.

Disadvantage: The developers of the model will most likely ignore real problems in an attempt to create the ideal in EE. This process may turn off school district administrators because of the enormity of the task and teachers because of its lack of immediate pay-off in the classroom.

2. Developing a sequence and establishing objectives for each grade level.

This step would include the writing of behavioral objectives for each grade level. Objectives would be judged appropriate in terms of their relevancy to the assumptions made in the learning model and the writers

EEC Implementation of the Infusion Approach

1. Analysis of existing district curriculum guides:

This step involves teacher training in the writing of EE activities to correspond with topics in the existing district curricula.

Advantages: Teacher involvement in the initial stage insures future commitment to the product. Using existing curricula as a base increases the chance of implementation.

Disadvantages: A global view is abrogated for practical advantage. Idealism in establishing goals may be compromised by what already exists. Frustrations over purpose and product may build. The lack of cohesiveness is always felt.

2. Development of EARTHWATCH, two EE activity booklets by teachers from school districts

Classroom teachers created and selected activities in EE which they judged appropriate for each grade level and each content area. The final product of this effort was the creation of two volumes of carefully designed activities

understanding of learner readiness.

Advantages: Once objectives have been established material selection and activity development is relatively easy. The objectives insure if translated into learning activities a sequential development of concepts and skills.

Disadvantages: The objectives may be perceived by teachers as idealistic or unrelated to what they are presently undertaking in the classroom. Most likely teacher involvement at this stage is minimal and a sense of teacher ownership is lacking.

3. Development of activities to meet the established objectives:

This step would include massive revision of existing curricula to conform to the established objectives.

Advantages: A precise selection of materials and activities to meet each objective is relatively easy given the specificity of the objectives and the learning model. Sequencing of activities is guaranteed.

Disadvantages: Complete revision of curricula involves both a tremendous monetary commitment on the part of school districts and a professional commitment on the part of district staff to material development without immediate pay-off. Often the objectives will be adopted without provision for accomplishing them in the classroom.

4. Implementation of the total curriculum at the district level:

Advantages: The total package is implemented at every grade level all at once. Clear responsibility for teaching EE is established. The program, because it is a total package, has credibility. Every objective can be related to the learning model. Every activity can be related to an objective.

to highlight environmental concepts.

Advantages: The creation of a product which can be used by teachers immediately without serious curriculum alteration or training. The creation of a sense of involvement by teachers and a sense of ownership. The ease of implementation offers the opportunity to solicit recruits from the ranks of teachers who had no prior commitment to EE.

Disadvantages: There is no guarantee that teachers will use the activity booklets to foster the sequential development of concepts and skills. Teachers will be tempted to include the activities which have relevance for their current discipline instructional program and may lose sight of the overall goals of EE.

3. Development of concepts and objectives to insure a degree of cohesiveness in the total EE program:

This step included the writing of concepts and objectives by the EEC staff for each grade level based on what is currently being taught in the subject matter disciplines.

Advantages: Teachers and administrators are presented with concepts and objectives which can be integrated into existing programs at minimal cost and little retraining of teachers.

Disadvantages: Having developed a series of easily adapted activities for teaching EE in step 2, teachers may be unwilling to look at the total picture because they have something that works at their grade level.

4. Development and implementation of a learning model which both meets the learners needs and the objectives established in step three:

Advantages: Teachers at this point have been using the activity booklets and are coordinating efforts to insure appropriate competency development at each grade level. They are ready to adopt a learning model which permits them to deal with individual learner differences.

Disadvantages: Teachers and administrators will probably offer resistance at this point because they have not been prepared in the previous steps. Outright rejection by a school district at this point would lead to total destruction of all efforts to introduce EE concepts. It would be easy to reject any introduction of EE at this stage by rejecting the original model. Hence the process might become a purely academic pursuit.

Disadvantages: The need for a learning model may be reduced as was the need for objectives given the fact that teachers have activities which work with learners. Lip service may be given to the model but implementation by district staff could be minimal.

As outlined above, the infusion approach to EE as applied in the EARTHWATCH curriculum, offers a practical approach to EE but may not insure the sequential development of EE concepts and skills. Recognizing that the EARTHWATCH activities could lead teachers to adopt a 'shotgun approach to EE, the EEC staff sought to construct a conceptual model which would provide teachers with a guide for specific competencies to be mastered at each grade level.

Initial attempts at model development involved researching existing conceptual models. These models were found lacking in three important respects:

1. Most existing conceptual models were inconsistent with the infusion approach in that they had little connection with what is being taught within district schools.
2. Most existing conceptual models assumed that student mastery of the concepts central to the natural sciences guaranteed competency in environmental education. Existing frameworks minimized humankind's interaction with the natural environment and downplayed the resulting environmental dilemmas.
3. Many conceptual models offered simplistic and merely descriptive objectives for observing the natural environment and avoiding more complex environmental issues and skills.

Dissatisfaction with existing models led the EEC staff through a process of development which would provide EE concepts and competencies at each grade

level. These competencies would focus on human interaction with the natural environment as well as facilitate the infusion of EE activities within existing district curricula. This process consisted of the following steps:

1. Identifying the major concepts in EE contained under each of the seven topics included in EARTHWATCH.
2. Identifying by analysis of existing subject curricula the concepts and competencies students would need to master before the introduction of environmental competencies.
3. Writing behavioral objectives for each of the EE concepts and for each grade level. It should be noted that at this stage all natural science objectives were assumed to be included under existing subject area curricula. A conscious decision was made by the staff to limit EE competencies to those dealing with human interaction with the environment. To be candid we assumed that teaching the natural sciences and calling it environmental education was a copout. It is our desire that teachers teach the natural sciences but be under no delusion that they are teaching EE.
4. Conduct a series of working sessions with district teachers at each grade level to obtain a reaction to the curriculum assumptions the staff made as a result of step 3. In addition to facilitating the grade level placement of specific objectives, it is the goal of EEC staff to demonstrate to teachers the opportunities for infusing EE objectives in their present curricula. The circulation of this working paper for critique is an integral part of this step.
5. Revision of EE objectives in accordance with teacher reaction and evaluation. This process involves both revision of the placement of objectives by grade level and revision of the natural and social studies content assumptions which the EEC staff considered were a necessary foundation to teaching EE.

6. Identifying or creating activities for each concept and objective at each grade level in specific subject areas. This product would not only provide the teacher with a model for desired learner outcome but a variety of ways to achieve it. In addition, the potential activities would be infused into the curriculum.
7. Disseminating the final product. This task given the process described above, should be the least difficult. Teachers created Earthwatch. Teachers were the evaluators of the objectives. Teachers are provided activities to implement the objectives in their curricula. The task is insuring that teachers are aware not only of the objectives but of the activities to implement the objectives. It is a task of demonstrating to teachers how what they are already doing can achieve the goals of EE with a minimum of effort.

The most crucial element to making the project successful is to match the competencies to existing EE curriculum activities by finding those activities which teach the competencies using an infusion approach. Using Earthwatch, Project Learning Tree, Outdoor Biological Instructional Strategies and other excellent resources from the Environmental Education Center Library, the staff will develop an index using the following format:

EE COMPETENCY	GRADE	SUBJECT (CURRICULUM)	RESOURCE	PAGE #S
the learner will identify one natural cycle of which they are part	K-3	science	EARTHWATCH	Vol. I, p.58
		language arts	OBIS EARTHWATCH	Set 1 Vol. I, p.89

This process will insure their useability in the classroom.

The final plan is to meet with individual districts, present them our model competency goals and work with them to incorporate the environmental competencies into the school curriculum goals by selecting and modifying the

competencies. After this link has been made, we will go to the classroom teacher with the appropriate competencies and provide access to the activities to teach these environmental concepts using our infusion approach. Earthwatch will be the model curriculum for insuring the success of the project. However, the Environmental Education Center Library is full of curriculums which, with the proper focus in mind, can be selected to enhance both the EE competencies and the school curriculum. Developing an index to these resources will be a major outcome of the competency project.

At this stage our conclusions regarding both the process and product are listed below:

1. Estimates of the work involved in terms of staff time were grossly underestimated. In the main this occurred because the staff decided to work with existing subject matter. In the long run, we are convinced that implementation time will offset development time because we are dealing with subject matter and concepts with which teachers already deal.
2. The emphasis on human interaction with the environment has advantages and disadvantages.
 - (a) The competencies will provide a tool for evaluating a school's curriculum for its EE content. In addition, a mechanism for strengthening the content without major curriculum alterations will be available.
 - (b) The competencies will provide teachers a concrete, political wedge for requesting that EE goals be incorporated into a district's curriculum plans.
 - (c) The Environmental Education Center will have an internal tool for evaluating its many professional development services.
 - (d) Teachers who feel they teach all environmental concepts when they teach natural science may be alienated. They will be asked to significantly alter their understanding of EE.
 - (e) The assumptions made of what is already taught by teachers in subject areas may pose a threat to some teachers. This can only be overcome by support from their administrators and the EEC staff.

3. EE is not totally a cognitive process. It is the product of a dynamic growth cycle incorporating the affective growth of the EEC staff, teachers, parents and students. It is this process rather than any product which has strengthened and focused EE plans at the Environmental Education Center. Earthwatch, the competencies, the curriculum ideas will continue to evolve and be modified by staff and teachers but the product modification will occur in the context of a learning model for environmental education which has emerged.

The following product is a first draft. We are circulating it for comments, reviews and revisions. It is a working paper; please use it as such.

ECOSYSTEMS

CONCEPTS CENTRAL TO ENVIRONMENTAL EDUCATION

1. CYCLES: Humankind can alter natural cycles and destroy their tendency toward equilibrium.
2. INTERDEPENDENCE: Humankind's recognition of its dependence on natural cycles is necessary for its survival.
3. LIMITS: Humans can alter the availability of a given life need in the environment.
4. CHANGE: Humankind may effect the rate of change in an environment.

CONCEPTS ASSUMED INCLUDED IN EXISTING CURRICULA

1. CYCLES: Biological cycles are described as dynamic because the materials and energy involved are parts of continuous cycles.
2. INTERDEPENDENCE: All living organisms are dependent on each other and their environment.
3. LIMITS: In any environment the form of life depends on the coincidence of the life needs and their availability.
4. CHANGE: Organisms and environments are in a constant state of change.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

ECOSYSTEMS I - CYCLES - K-3

1. Given a plant or animal, the learner will indicate through drawing three ways humans have influenced its life cycle.
2. The learner will identify one natural cycle that they are part of.

ECOSYSTEMS I- CYCLES 4-6

1. The learner will describe types of natural decomposition and identify ways human actions have changed these natural cycles.
2. The learner will construct a food web for an eco-community he/she has observed and give examples of methods which could be used to prevent human interruption of the food web.
3. Given a natural cycle (oxygen, hydrologic, etc.), the learner will identify human impacts on the cycle.

ECOSYSTEMS I - CYCLES 7-9

1. Given a specific cycle (carbon, nitrogen, oxygen, hydrogen), the learner will give examples how the manipulation of one component in a cycle affects all components in that cycle.
2. Given a human activity, the learner will give examples of how this activity will affect the components of a natural cycle.
3. The learner will, when given an environmental problem, list the natural cycles involved.
4. Given alternative plans of human action, the learner will hypothesize the consequences of each action on the affected natural cycles.
5. The learner will develop a plan to return a disturbed cycle to its state of equilibrium.

ECOSYSTEMS I - CYCLES 10-12

1. The learner will establish criteria with which to evaluate the impact of a proposed action on the natural cycles involved.
2. Given alternative courses of action, the learner will evaluate the alternatives using his criteria from step 1.
3. Given a set of criteria, the learner will evaluate a human made cycle which attempts to duplicate a natural cycle.

ECOSYSTEMS 2 - INTERDEPENDENCE K-3

1. The learner will list all the natural things he uses in a given day.

ECOSYSTEMS 2 - INTERDEPENDENCE 4-6

1. The learner will trace three products back to their origin to illustrate human dependence on the natural environment.
2. The learner will diagram the interrelationships of animals and plants in a community and explain how the learner's activities might affect this community.

ECOSYSTEMS 2 - INTERDEPENDENCE 7-9

1. The learner will demonstrate how people are part of the ecosystem.
2. Given human species as an important biotic element, the learner will identify the interaction of abiotic and biotic elements of a specific ecosystem.
3. Given a minimum of three cultures (ones the learner studies in grades 7-9) plus the United States, the learner will compare and contrast their perception of these cultures and their dependence on the natural environment. (Show how concept of interdependence changes with culture.)
4. Show how culture's perception of interdependence is reflected in the cultures interaction with environment. (possibly 10-12)

ECOSYSTEMS 2 - INTERDEPENDENCE 10-12

1. Given a source of information, the learner will be able to diagram the interdependence.
2. The learner will rank order given cultures in terms of their actions as recognizing the interdependence of all living things.
3. The learner will hypothesize causes for different views of interdependence among cultures.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

ECOSYSTEMS 3 - LIMITS K-3

1. Given a plant or animal, the learner will identify its life needs and explain how people can affect the availability of items to satisfy these life needs.

ECOSYSTEMS 3 LIMITS 4-6

1. The learner will demonstrate how the deficiency of any three of the following affect the ability of an organism to survive:
 - a. sun light
 - b. oxygen
 - c. water
 - d. food
2. The learner will give examples how humans have affected the above and the resulting effects on various organisms.
3. The learner will list ways in which his/her use of an environmental element can affect the ability of plants and animals to satisfy their life needs.

ECOSYSTEMS 3 LIMITS 7-9

1. The learner will demonstrate how the deficiency of any three of the following affect the ability of an organism to survive:
 - a. carbon dioxide
 - b. protein
 - c. space
 - d. nitrogen
 - e. phosphorus

2. The learner will give examples how humans have affected the above and the resulting effects on various organisms.
3. The learner will identify (a minimum of 3) limiting factors which effect his behavior.

ECOSYSTEMS 3 LIMITS 10-12

1. The learner will identify the limiting factors in a given ecosystem and give examples of human manipulation of those factors.
2. The learner will develop a plan to correct imbalances in a given ecosystem caused by human manipulation.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

ECOSYSTEMS 4 - CHANGE K-3

1. The learner will classify environmental changes from before and after pictures as natural or human caused.
2. The learner will describe ways in which human presence in the community has produced changes from its original.

ECOSYSTEMS 4 - CHANGE 4-6

1. The learner will give examples of how humans have both adapted to their environment and have altered the environment to survive.
2. Given a declining species, a student will be able to identify the changes that led to this decline.

ECOSYSTEMS 4 - CHANGE 7-9

1. The learner will state several ways human land use (agriculture, suburbanization and urbanization) changes natural communities (woodlands, pond).
2. The learner will describe how man's alteration of the environment may increase or decrease the rate of change within that environment.
3. The learner will develop a plan to reduce the rate of habitat destruction in his/her community.
4. The learner will identify animals which have been able to adjust to urbanization and animals which have been unable to adjust.

ECOSYSTEMS 4 - CHANGE 10-12

20

1. Given a specific construction site, a student will predict change and rates

of change (vegetation, habitat, soil).

2. Given a declining species, a student will be able to identify the changes that led to this decline.
3. Given a specific issue, the learner will state four ways in which humans can alter the rate of change.
4. The learner will give examples of corrective steps people have taken to restore the natural rate of change to environments which have been manipulated by people.
5. The learner will predict the rate of climatic change in a given area and relate it to natural or human causes.

POPULATION

CONCEPTS CENTRAL TO ENVIRONMENTAL EDUCATION

1. **CHANGE:** Humankind has the ability to determine the rate of population growth or decline.
2. **DISTRIBUTION:** Human populations are unevenly distributed with respect to natural resources.
3. **STRUCTURE:** The structure of a given human population influences the impact of that population on the environment.
4. **IMPACT:** The environmental impact of a given human population is the product of total population and consumption.

CONCEPTS ASSUMED INCLUDED IN EXISTING CURRICULA

1. **CHANGE:** The growth rate of a given population is dependent on the birth and death rates.
2. **DISTRIBUTION:** The density of population varies throughout the world.
3. **AGE STRUCTURE:** The age structure of given populations vary.
4. **IMPACT:** Societies consume at different levels.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

POPULATION 1 - CHANGE K-3

The learner will graph the growth of a plant or animal population over a specific period of time.

POPULATION 1 - CHANGE 4-6

1. The learner will give five examples of how humankind has effected the number of people who die in a time period (death rate).
2. Given the birth rate and death rate of a given population, the learner will determine whether the population is growing or declining.
3. The learner will compare the available space per person today with the space available per person in the year 1900.

POPULATION 1 - CHANGE 7-9

1. Given three societies with differing value systems, the learner will cite the values that influence family size.
2. The learner will describe several methods of birth control.
3. The learner will list five causes for the increase in average life expectancy the U.S. over the last hundred years.

POPULATION 1 - CHANGE 10-12

1. The learner will identify sources of family planning information within his/her community.
2. The learner will evaluate methods of increasing or decreasing population growth in terms of effectiveness, usability and moral acceptability.
3. The learner will identify and evaluate current government programs aimed at reducing or stimulating population growth.

4. The learner will list the obstacles to reducing world population growth rates.
5. The learner will propose a plan of action to meet the obstacles reducing world population growth rates.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

POPULATION 2 - DISTRIBUTION K-3

1. The learner will identify through pictures areas of high population density and those of low population density.
2. The learner will compare the number of people living in a city with the number of people living in a rural community.

POPULATION 2 - DISTRIBUTION 4-6

1. The learner will identify areas of dense population on a map of the United States or other maps.
2. The learner will use maps to compare density of population within an area and the resources present in the area.
3. The learner will give three examples of migrations which have occurred due to the lack of resources given the population.

POPULATION 2 - DISTRIBUTION 7-9

1. The learner will identify five nations in which population growth is exceeding the available resources.
2. For the food and oil resource, the learner will identify the four major exporters and importers of each resource.
3. Given the above conditions, the learner will differentiate among the movement of resources to people and people to resources.
4. The learner will give examples of how population density has effected life-styles.

POPULATION 2 - DISTRIBUTION 10-12

1. The learner will hypothesize the impact population density has on human behavior.
2. The learner will relate political unrest to crowding and defend their inferred relationships by reviewing the history of armed conflict.
3. Given a population growth rate, the learner will predict population densities of nations in the year 2000.
4. The learner will list the problems resulting from his above predictions.
5. The learner will list variables that may influence his predictions.
6. Given a plan to redistribute world population, the learner will evaluate the plan in terms of social, economic, and environmental consequences.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

POPULATION 3 - STRUCTURE K-3

1. The learner will arrange the classroom population by a specific characteristic such as height, month of birth, birth order, etc.

POPULATION 3 - STRUCTURE 4-6

1. The learner will calculate the average number of children per family among families they are acquainted with.

POPULATION 3 - STRUCTURE 7-9

1. The learner will construct an age structure diagram when given the necessary data.
2. The learner will compare two age structure diagrams in terms of the population growth potentials of each.

POPULATION 3 - STRUCTURE 10-12

1. The learner will state the impact of a young marriage age on age structure of a given population.
2. The learner when given an age structure diagram for a population will identify the dependency load.
3. The learner will compare ethnic population age structures within the United States.
4. Given three population pyramids representing a nation over a time period, the learner will predict the political, social, economic and

environmental consequences of that structure.

5. The learner will construct an age structure diagram which he/she considers ideal for the United States and explain his/her rationale.
6. The learner will identify the factors that affect fertility and explain their influence.
7. The learner will predict the change in population age structure for an increasing or decreasing fertility rate.
8. The learner will evaluate plans to reduce or increase fertility rate in terms of the impact such a reduction would have on age structure.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

POPULATION 4 - IMPACT K-3

1. The learner will list the products his family consumes in a day.
2. Given a specific resource (i.e. paper), the learner will show through drawing the amount of resource used if the class was doubled in number and if the class size was reduced by one half.
3. Given a specific resource (i.e. paper), the learner will show through drawing the effect of reducing class consumption by 50%.

POPULATION 4 - IMPACT 4-6

1. The learner will calculate the per capita consumption of a given resource by his/her classmates.
2. The learner will compare his/her per capita consumption of a given resource with other members of the class.
3. The learner will locate nations on a map which have high population and low consumption rates and nations which have low population but high consumption rates.
4. The learner will list five items he/she would be willing not to consume and explain how they could be used by others.

POPULATION 4 - IMPACT 7-9

1. Given a list of nations, the learner will rank order the nations by per capita consumption of various resources and by population growth rate.

POPULATION 4 - IMPACT 10-12

1. The learner will develop a plan to reduce total environmental impact for a given nation which includes reducing population growth rates and stabilizing or reducing consumption.
2. The learner will develop a model for relating populations growth rate, consumption, and environmental impact and apply it to five nations. The learner will explain the impact on society of increasing life expectancy.

RESOURCES-ENERGY

CONCEPTS CENTRAL TO ENVIRONMENTAL EDUCATION

1. **DEPLETION:** All resources and energy are subject to depletion in quantity and quality by humankind.
2. **MANAGEMENT:** Humankind has the capability of extending the base of renewable resources and decreasing the rate of depletion of usable energy supplies and non-renewable resources.
3. **RECYCLING:** The recycling of materials and energy will decrease the rate of depletion of natural resources.
4. **DISTRIBUTION:** Natural resources including energy are unequally distributed with respect to land areas and political bound
5. **CONVERSION:** The means a society employs to convert energy and natural resources into usable form affects the rate of depletion and the environmental quality.

CONCEPTS ASSUMED INCLUDED IN EXISTING CURRICULA

1. **DEPLETION:** Resources can be classified as renewable and non-renewable.
2. **MANAGEMENT:** Utilization of resources and energy is dependent on the lifestyles adopted by a society.
3. **RECYCLING:** The reuse of materials and energy in a society depends on the values of the society and the availability of resources and energy.
4. **DISTRIBUTION:** A society's standard of living is influenced by the availability of energy and resources.
5. **CONVERSION:** Energy and natural resources can be converted to usable forms by alternative methods.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

RESOURCES - ENERGY: 1 DEPLETION K-3

1. The learner will be able to name sources of energy which are used daily.
2. The learner will measure the rate of depletion (time measure to use up) of a classroom resource (pencil, paper, chalk, etc.)
3. The learner will give examples of how the production of goods to satisfy a particular need uses resources.

RESOURCES - ENERGY: 1 DEPLETION 4-6

1. The learner will identify resources in the community which are under going depletion.
2. The learner will identify resources which are undergoing depletion because of a lack of management.
3. The learner will identify give current causes for resource depletion.
4. The learner will relate the increased demand for energy to resource depletion.
5. The learner will clarify resources as renewable and non-renewable.
6. The learner will give one example of how the depletion of a resource may increase the demand for other resources.

RESOURCES - ENERGY: 1 DEPLETION 7-9

1. The learner will list ten methods by which energy consumption could be reduced in their home.
2. The learner will be able to rate a list of products in terms

of the energy and other resources consumed in their production and utilization.

3. The learner will list the steps needed to reduce consumption of a given resource.
4. The learner will compare and contrast depletion of resources based on consumption rates existing in 1900 and those existing today (such as coal, wood, oil, bauxite).

RESOURCES - ENERGY: 1 DEPLETION 10-12

1. The learner will predict the impact of different consumption levels on resource depletion rates.
2. The learner will be able to identify the variables involved in determining the rate of depletion of a given resource.
3. The learner will document the feasibility of technology extending or reducing the zero supply date of a given resource or energy supply.
4. The learner will predict the impact a given rate of depletion of a resource will have on world production of goods.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

RESOURCES - ENERGY: 2 MANAGEMENT K-3

1. The learner will propose a management plan for resources used in the classroom
2. The learner will plan and execute a project to attract birds and wildlife to the school grounds.
3. The learner, when given a list containing items wasted in the home, will develop a plan to reduce waste.
4. The learner will list three items which he wastes and inform the class of the steps he plans to take to reduce waste.

RESOURCES - ENERGY: 2 MANAGEMENT 4-6

1. The learner will list changes in living habits which he/she could make to decrease the consumption of a specific resource.
2. Given specific examples, the learner will differentiate among managed and unmanaged resources.
3. The learner will identify resources which are undergoing depletion because of a lack of management.
4. The learner will identify two management plans to reduce the depletion of energy.
5. The learner will cite examples of how wildlife management practices enable some animal species to be a renewable resource.

RESOURCES - ENERGY 2 MANAGEMENT 7-9

1. Given a wildlife management plan, the learner will indicate the impact of the plan on the affected species.
2. Given a management practice (soil, wildlife, energy, mineral,

- etc.), the learner will list criteria to evaluate that practice.
3. Using the criteria defined in Objective #2, the learner will evaluate that management practice.
 4. Given a specific mineral resource, the learner will develop a plan to produce maximum benefit with the least environmental impact.
 5. The learner will identify existing water management practices.
 6. The learner will develop criteria for evaluating, and evaluate the water management practices.

RESOURCES - ENERGY 2 MANAGEMENT 9-12

1. The learner will prioritize a list of resources in terms of the need for increased management.
2. The learner will design a plan of communicating the need for action to reverse the depletion or the need for action to retard the depletion of a non-renewable resource.
3. The learner will identify five government programs aimed at managing resources.
4. Given a resource (abiotic or biotic), the learner will (a) identify alternative management strategies and (b) develop criteria for selection and select the best management strategy.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

RESOURCES - ENERGY 3 RECYCLING K-3

1. The learner will identify items which can be used more than once.
2. The learner will propose alternative uses for containers other than throwing them in the garbage.
3. The learner will use scrap paper to make a project.
4. The learner will identify examples of recycling in his/her home.

RESOURCES - ENERGY 3 RECYCLING 4-6

1. The learner will predict the effects of paper recycling on forests.
2. Given a specific resource with two management plans (one including recycling and the other without), the learner will compare and contrast depletion patterns.
3. Given the appropriate information, the learner will calculate the tons of materials produced in the United States which could be recycled.
4. The learner will survey ten families to determine if they would be willing to recycle wastes.

RESOURCES - ENERGY 3 RECYCLING 4-6

1. The learner will use current data on the use of minerals to project future reserves and state how mass recycling would change this projection.

2. The learner will take a position on the issue of using non-returnable bottles in school and defend it.
3. The learner will describe current government programs to promote the recycling of wastes.
4. Given a specific resource, the learner will plan and publicize a recycling project for that resource.
5. The learner will give examples of how management and technology have combined to maintain the productivity of land.
6. The learner will compare and contrast the cost of producing a good from virgin material or recycled material.

RESOURCES - ENERGY 3 RECYCLING 10-12

1. Given a collection goods, the learner will classify items in one of the following categories:
 - a. returnable and reusable in form
 - b. reclaimable by-product
 - c. recyclable by technology
 - d. recyclable with large energy inputs
 - e. practically non-recyclable
2. Given a series of laws or regulations dealing with solid waste disposal, the learner will identify those which encourage recycling.
3. The learner will develop a plan to recycle water in his community.
4. The learner will propose a plan to reduce the cost of recycling resources.
5. The learner will evaluate the effectiveness of an existing recycling program in his community.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

RESOURCES - ENERGY 4 DISTRIBUTION K-3

1. The learner will through the use of pictures demonstrate resources found in other communities which are not found in his own.
2. The learner will describe what his life would be like without electricity, water, a given food item.

RESOURCES - ENERGY 4 DISTRIBUTION 4-6

1. The learner will give examples of how the access to sources of energy affects the lifestyle of a particular society.
2. The learner will list resources which are in short supply in the United States.
3. Given a resource, the learner will identify those areas of the world in which the resource is abundant and those areas in which it is scarce.
4. The learner will locate on a map those areas of the world (or only the United States) which do not have sufficient water for crop cultivation.

RESOURCES - ENERGY 4 DISTRIBUTION 7-9

1. The learner will write a scenario describing the impact of decreasing imports on the life style of citizens of the United States.

2. The learner will name five nations which are dependent on the sale of resources for their economic survival.
3. The learner will name five nations in which economic growth depends on importation of natural resources.
4. The learner will diagram the flow of fossil fuel energy through the world.
5. Given a resource (e.g. bauxite), the learner will locate the natural reserves of the resource with the ten most populous nations and the ten most consumptive nations.

RESOURCES - ENERGY 4 DISTRIBUTION 9-12

1. The learner when given a product will determine:
 - a. the resources used in its production
 - b. the source of resources (location) used in its production
 - c. the amount of energy used in its production
 - d. the source of energy used in its production
2. The learner will identify nations having large quantities of resources in proportion to population and describe the impact of this relationship on life styles.
3. The learner will identify nations having small quantities of resources in proportion to population and describe the impact of this relationship on life styles.

RESOURCES - ENERGY 5. CONVERSION: K-3

Given a product the learner will identify the resources which are used in the production of the product.

The learner will demonstrate by measuring with a thermometer his/her understanding of heat loss in the energy conversion process by measuring the heat produced by an electric light bulb.

The learner will arrange in proper sequence pictures of the steps involved in the production and transmission of electrical power.

RESOURCES - ENERGY CONVERSION 4-6

The learner when given a diagram of an energy transfer chain will identify the sources of waste heat.

The learner will identify the environmental impacts of given resource conversion processes when given the steps involved in conversion of the resource to usable form.

The learner will develop a plan to reduce the waste of resources or energy by reducing the number of steps in the conversion process for a given product.

The learner will select a product from a series of products which is energy resource efficient because of the simplicity of the conversion process.

RESOURCES - ENERGY: CONVERSION 7-9

The learner will demonstrate his/her understanding of net energy by comparing the net energy produced by a nuclear power plant, a fossil fuel power plant, and a solar power plant.

The learner will outline steps which would reduce the steps of conversion for a given product or service.

The learner will compare the efficiency of electric space heating, oil furnace space heating and natural gas space heating in terms of the conversion processes used to provide each form of space heating.

The learner will give examples of how two human needs could be satisfied with a decrease in the number of conversion steps.

RESOURCES - ENERGY: CONVERSION: 10-12

The learner will identify three forms of technology which increase the steps in conversion and three forms of technology which decrease the steps in conversion.

The learner will develop a plan to increase the net energy or resource yield of a given source by reducing the conversion steps.

The learner will identify changes in lifestyle which would be necessary to increase the net energy yield of a given energy source.

The learner will explain the second law of thermodynamics in terms of waste heat and its relation to a given conversion process employed in creating useful energy.

ECONOMICS - TECHNOLOGY

CONCEPTS CENTRAL TO ENVIRONMENTAL EDUCATION

1. **CONSUMPTION:** The impact a given economy has on the environment varies with both the type and quality of goods consumed.
2. **PRODUCTION:** The impact a given economy has on the environment varies with the method of production employed by the society.
3. **INTERDEPENDENCE:** To determine the impact a society has on the environment, one must take into account the level of consumption and the means of production.

CONCEPTS ASSUMED INCLUDED IN EXISTING CURRICULA

1. **CONSUMPTION:** Both the level and types of products consumed by a society depends on that society's perceived needs and wants and the ability of the economy to meet those needs and wants.
2. **PRODUCTION:** Goods and services are produced by the interaction of labor, capital, and natural resources.
3. **INTERDEPENDENCE:** Each society is dependent on others for the production of goods and services.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION.

ECONOMICS & TECHNOLOGY 1 - CONSUMPTION K-3

1. The learner will give examples of goods he/she uses everyday which he/she does not need to use.
2. The learner will classify goods using pictures into items that last a long time and items that last a short time.

ECONOMICS & TECHNOLOGY 1 - CONSUMPTION 4-6

1. The learner will calculate the total amount of any one resource (energy, paper, food) he/she consumes in a day through the consumption of non-essential goods.
2. The learner will give examples of how the production of a service uses resources.
3. The learner will compare the goods he/she uses in a day with the goods his/her parents and or grandparents used when they were young in terms of the amount of resources used in each generation.
4. The learner will give examples of how increasing the life span of a non-durable good will reduce the amount of resources consumed in production.
5. The learner will compare two goods produced to serve the same purpose (packaging, transportation, etc.) in terms of the resources used in the production of each good.
6. The learner will compare the amounts and types of food he/she consumes with the amounts types and quality of food consumed by less affluent nations.
7. The learner will give examples of advertising affecting his consumption and state the impact this has had on resources.

ECONOMICS & TECHNOLOGY 1 - CONSUMPTION 7-9

1. The learner will identify four goods which have built in obsolescence.
2. The learner will estimate the life expectancy of various "durable goods" and estimate the reduction of environmental impact if the life expectancy could be extended by 10%.
3. The learner will compare the minimum amount of packaging required by a given good with the amount of packaging provided by the distributor of the good in terms of the resulting impact on resources.
4. Given a list of alternatives designed to accomplish a specific purpose such as packaging, storage of food or nutrition, the learner will be able to select the least resource intensive alternative.

ECONOMICS & TECHNOLOGY 1 - CONSUMPTION 10-12

1. Given a specific good and a list of nations, the learner will rank order the consumption rates in terms of resource used in the production of that good.
2. The learner will outline a plan whereby his/her consumption of goods could be reduced without affecting satisfaction of his/her basic needs.
3. The learner will list two examples of increasing consumption resulting in economic and political problems.
4. The learner will list the five major impacts of a 10% increase and a 10% decrease in consumption of goods.
5. The learner will evaluate the impact advertising has on increasing the consumption of depletable resources.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

ECONOMICS & TECHNOLOGY 2 - PRODUCTION K-3

ECONOMICS & TECHNOLOGY 2 - PRODUCTION 4-6

1. The learner will compare the amount of resources consumed in the production of a good using two different production processes.
2. The learner will compare production processes used today in the U.S. with production processes used in the 1700's in terms of the resources used to produce a given good.
3. The learner will compare the resources consumed in the production of a good made by hand with a similar good made by machine.
4. Given alternative methods of producing a good, the learner will select the least resource intensive method.
5. The learner will list three examples of technology increasing resource use efficiency.
6. The learner will list three examples of technology decreasing efficiency of resource use.

ECONOMICS & TECHNOLOGY 2 - PRODUCTION 7-9

1. Given two definitions of "efficiency" (one in terms of dollar cost of production and the other in terms of resource consumption), the learner

will differentiate between the two definitions of efficiency.

2. The learner will apply the two definitions of efficiency to the production of various goods and services by citing an example of each definition.
3. The learner will define "appropriate technology".
4. The learner will give examples of current use of "appropriate technology" and cite several examples of potential use.
5. Given case studies of increased agricultural production, the learner will evaluate the environmental consequences (both positive and negative).
6. Given alternative modes of transporting goods, the learner will identify the least resource intensive mode including energy conservation, pollution and human convenience.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

ECONOMICS 3 - INTERDEPENDENCE K-3

1. The learner will identify by pictures items made in the home and items made elsewhere.
2. The learner will name three goods which he/she uses which are made in a community other than his own.
3. The learner will identify by pictures resources which are extracted in various parts of the world.

ECONOMICS 3 - INTERDEPENDENCE 4-6

1. The learner will locate on a map the origin of food products he/she consumes.
2. The learner will trace the source of the water he/she uses.
3. The learner will identify goods which are produced with resources originating in other nations.
4. The learner will give examples of how his/her consumption of a given good has an impact on the resources of another nation.
5. The learner will give examples of how a good produced in the U.S. for foreign consumption affects the resources of of the U.S.

ECONOMICS 3 - INTERDEPENDENCE 7-9

1. The learner will write a scenario describing the economic impact of the suspension of foreign resource importation to the U.S.
2. The learner will provide an explanation of the location of an industry based on the distribution of resources used in that industry.

3. Given a major commodity, the learner will rank order nations which depend on the export of that commodity and those which depend on the import of that commodity.
4. The learner will locate on a map the most productive areas for food production and contrast this map with a map of population distribution and economic wealth.

ECONOMICS 3 - INTERDEPENDENCE 10-12

1. The learner will identify five major world problems which originate from the unequal distribution of resources,
2. The learner will trace the history of a given nation in terms of its search either for a market for its goods or a search for a supply of natural resources.

ENVIRONMENTAL QUALITY

CONCEPTS CENTRAL TO ENVIRONMENTAL EDUCATION

1. VALUES: Judgments as to the quality of the environment depends on a society's values.
2. HEALTH: Improvement in environmental quality will have a positive effect on each individual's physical and mental well being.

CONCEPTS ASSUMED INCLUDED IN EXISTING CURRICULA

1. VALUES: Values held by a society influence an individual's lifestyle.
2. HEALTH: An organisms well being is dependent on how well the environment meets his life needs.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

ENVIRONMENTAL QUALITY - VALUES K-3

1. When given a series of pictures of various environments, the learner will identify those which he/she likes and does not like and explain why.
2. The learner will compare and contrast the picture he likes the best with his present environment.
3. The learner will identify the changes that would have to be made in order to bring his/her present environment into line with his/her ideal environment.

ENVIRONMENTAL QUALITY - VALUES 4-6

1. Given representative lifestyles of different societies, the learner will describe how each has defined "environmental quality."
2. The learner will identify the values which have contributed to the decline of a specific animal population.

ENVIRONMENTAL QUALITY - VALUES 7-9

1. Given a list of values and a corresponding list of environmental impacts, the learner will match each value to a corresponding impact.
2. Given a series of definitions of "quality environments", the learner will identify the values held by each of the authors.

ENVIRONMENTAL QUALITY - VALUES 10-12

1. The learner will identify three personal values explaining how those values influence their lifestyle.
2. The learner will identify the impacts which their lifestyle has on the natural environment.
3. The learner will outline changes in his/her values which would reduce environmental impact.

OBJECTIVES CENTRAL TO ENVIRONMENTAL EDUCATION

ENVIRONMENTAL QUALITY 3 - HEALTH K-3

1. The learner will name two effects that air pollution has on them.
(Other forms of pollution can be substituted.)

ENVIRONMENTAL QUALITY 3 - HEALTH 4-6

1. The learner will identify two diseases which can be traced to human activity.
2. The learner will compare and contrast people in crowded and uncrowded situations and report any behavioral difference.
3. The learner will outline a plan to reduce risks of attending school.

ENVIRONMENTAL QUALITY 3 - HEALTH 7-9

1. The learner will identify five occupations which have been associated with environmental health dangers.
2. The learner will evaluate the health impacts of smoking.
3. The learner will list three environmental health problems he/she has encountered.
4. The learner will evaluate plans to improve the quality of the environment in terms of impact of the plan on the health of the individual.
5. Given an environmental health problem, the learner will develop a plan to reduce or eliminate the causes.
6. The learner will identify the potential impact of a solid waste disposal on community health including water quality and air quality.

7. Given a list of substances, the learner will rank order the list according to their potential health risks.

ENVIRONMENTAL QUALITY 3 - HEALTH 10-12

1. The learner will trace the source of common respiratory illnesses.
2. The learner will investigate and develop criteria for evaluating attempts by government to provide safe working environments.
3. Given a list of environmental health hazards, the learner will categorize those that cause disease in the short term and those that cause disease in the long term.
4. The learner will develop a list of environmental health problems and prioritize them according to the size of population affected and the severity of the disease.
5. Given a major environmental health problem, the learner will propose alternative solutions and select one and defend it.
6. The learner will identify major sources of food contamination.
7. The learner will trace the location and concentration of dilute toxic metal or pesticide from its source to a food he eats.

ETHICS

CONCEPTS CENTRAL TO ENVIRONMENTAL EDUCATION

1. **AWARENESS:** To recognize oneself and all humans as part of the earth's biosphere.
2. **STEWARDSHIP:** To acknowledge and act as a protector of the earth rather than an exploiter.
3. **ADAPTATION:** To be willing to change lifestyles in order to reduce environmental impact.
4. **RESPONSIBILITY:** To assume an active role in the collective decision process to reduce the environmental impact of human activities.

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